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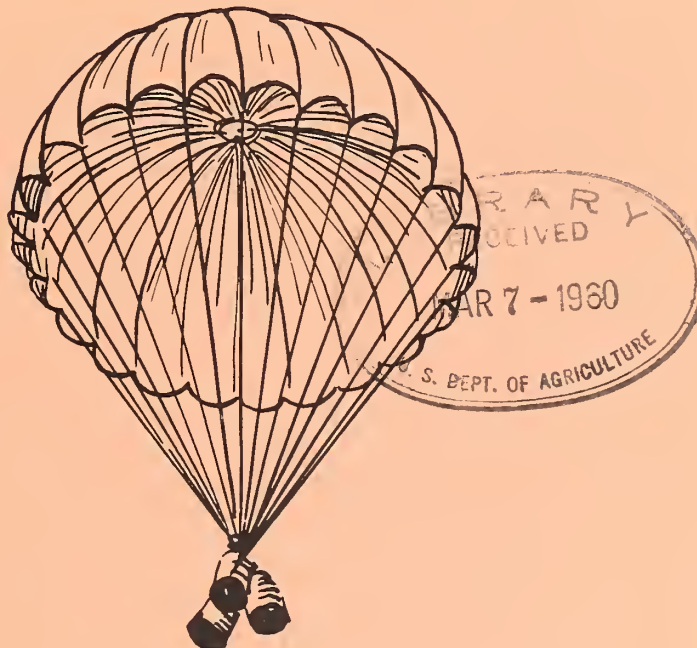
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TECHNICAL EQUIPMENT REPORT NO. F-3  
NOVEMBER 1958

# CARGO PARACHUTES

BY

MISSOULA EQUIPMENT DEVELOPMENT CENTER  
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE  
MISSOULA, MONTANA



FOREST SERVICE  
U.S. DEPARTMENT OF AGRICULTURE  
WASHINGTON, D.C.



## TECHNICAL EQUIPMENT REPORT NO. F-3

FOR

### CARGO PARACHUTES

Missoula Equipment Development Center  
Forest Service, U. S. Department of Agriculture  
Missoula, Montana  
November 1958

#### Introduction

To promote standardization of air equipment and provide better understanding, the Missoula Equipment Development Center has prepared a catalog of cargo parachutes. This information will be helpful to air officers and others planning and equipping an aerial supply unit. A list of cargo parachutes is provided to eliminate confusion in naming certain parachutes. Heretofore many of the common cargo parachutes have been named in accordance with the former military use. As a result of this practice, many misnomers have arisen. Certain parachutes are referred to by as many as three names (flare, bomb, air rescue, etc.). Names used herein will be based on size alone. It is hoped that this system will provide clearer definition for use in interregional exchange of equipment.

Most of the parachutes used in Forest Service air supply programs are of one basic design and type. Briefly, they consist of a circular flat canopy with a single webbing riser attached to a bag. The riser provides a means of attaching the parachute to the cargo and the bag is used as a container for the packed parachute and also as a retrieving bag for parachutes in the field. All Forest Service standard cargo parachutes are static-line operated. The cargo parachute static line is usually attached to the aircraft as a semi-permanent installation. A 3/4-inch black-japanned iron ring is tied into the apex break-cord to facilitate fastening the static-line snap. (For packing instructions see FSH 5710.)

The reliability of the standard circular-flat type canopy is well established. This canopy is used in more parachute designs and containers than any other type. Several kinds of containers are in use in the Forest Service; the most common, however, are those that allow the canopy to deploy before the lines are extended. The "canopy-first" deployment method allow for fast openings at low levels.



Most of the canopies used in Forest Service aerial supply are obtained through military surplus. The one exception is the square burlap. This parachute was formerly widely used throughout the service. Its chief advantage was its low cost and simple design. The parachute consists of a burlap sheet 8, 10, or 12 feet square with lines of nylon parachute cord tied to each corner. The burlap canopy is folded into a paper bag, which has a pull-out cord to rip the bag from the canopy after the parachute and load are discharged. Recently, large numbers of overage nylon surplus military parachutes have been made available to the Forest Service at no cost. These can be easily and economically converted to cargo parachutes. It appears that the manufacture of burlap parachutes as an expendable low-cost item can no longer be justified. Recent increases in burlap cloth prices tend to further substantiate this. The weave of burlap cloth not closely controlled and wide discrepancies in strength and permeability tend to make it unsatisfactory for canopies. In operation, the burlap parachute is the least reliable of all Forest Service parachutes. In view of these considerations, the burlap parachute is not included in the catalog of standard parachutes.

### Action

Rates of descent at various loads and altitudes shown in the catalog were determined by drag testing (fig. 1). In drag testing for rate of descent, the parachute is suspended horizontally on a line running between the truck mast and trailer A frame. The parachute riser is attached to a ball-bearing swivel which in turn is fastened to a line running over a free pulley to a measured weight (cargo). The truck is put in motion and the parachute inflates, lifting the weight. With the weight suspended (load and parachute drag in equilibrium) a measurement of airspeed is taken. Airspeed in feet per second is recorded over a 10-second interval. The average airspeed over the 10-second interval gives the rate-of-descent value for the drag test. Sixty-two airdrops and 140 drag tests were made in establishing these rate-of-descent figures.

Airdrop tests were made to check the reliability of drag data for each parachute. A comparison of measurements made by both methods shows that the towed parachutes had slightly higher drag values (about 3-1/2 percent) than airdropped parachutes which descended freely. Ground cushion effect at the lower perimeter of the towed canopies plus the reduced weight of horizontally suspended parachutes might account for the slightly increased drag efficiency of the captive parachutes. Corrected rate-of-descent values were obtained by multiplying all drag test values by .965.

All drag and test drops were conducted at 3,200-foot elevation on selected days when temperatures were near standard (59°F.). A multiplication factor for altitude (.02 per 1000 feet of increase) was applied to indicate rates of descent for sea level and the 5,000-foot elevation.

The rates of descent determined by drag testing and corrected for altitude agreed quite closely with aircrop rates of descent. Agreement between these figures and those given in the U.S.A.F. Parachute Handbook, section III, is quite close. The major differences probably were due to differences in air density. All data in the Parachute Handbook represent standard air conditions.

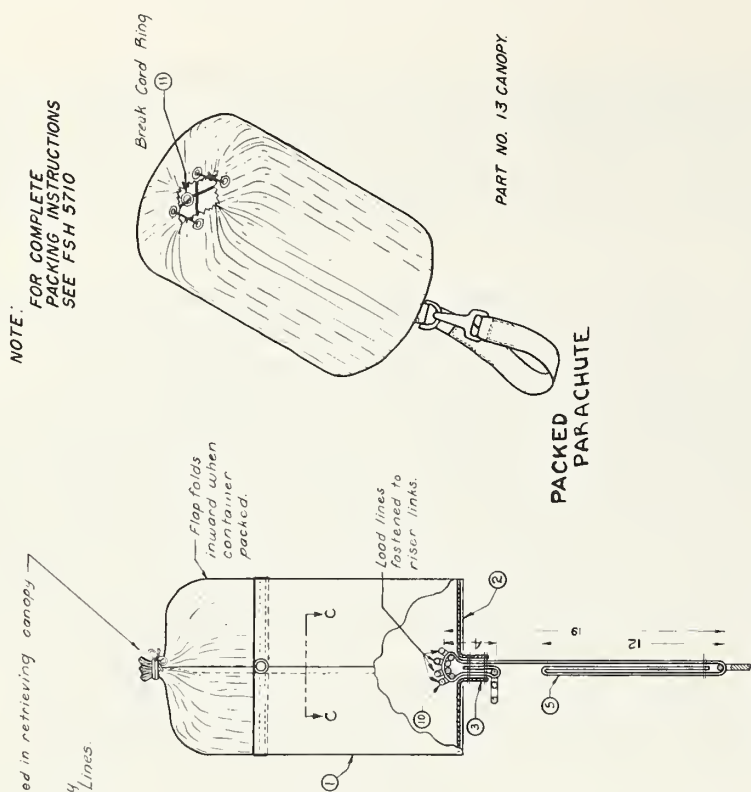
Altitude and its effect on rate of descent can be calculated in advance, since this factor remains constant. This correction was made in the catalog. Temperature, as it affects air density, is normally the greatest factor influencing parachute descent. The various factors affecting air density are practically impossible to measure and incorporate into usable data for forest cargo operations. Moreover, the urgency of fire situations and the rapidity or speed with which most aerial cargo delivery jobs must be conducted preclude any chance to apply rate-of-descent data. In case of doubt as to rate of descent, a larger parachute or a lighter load should be used. Generally speaking, most Forest Service cargo will land without appreciable damage if dropped at rates of descent not exceeding 20 feet per second. Nevertheless, certain cargo items because of fragility, cost, or priority on the job, need to have special protective packaging (radios, chain saws, and in some cases, water). At present very little information concerning the durability of cargo is available.

There is need for a classification of forest air cargo into classes such as fragile, average, and durable. The bases of classification might be an acceptable average rate of descent, an average ground condition, and an acceptable minimum amount of protective packaging



Figure 1.--Drag testing a 28-foot diameter cargo parachute

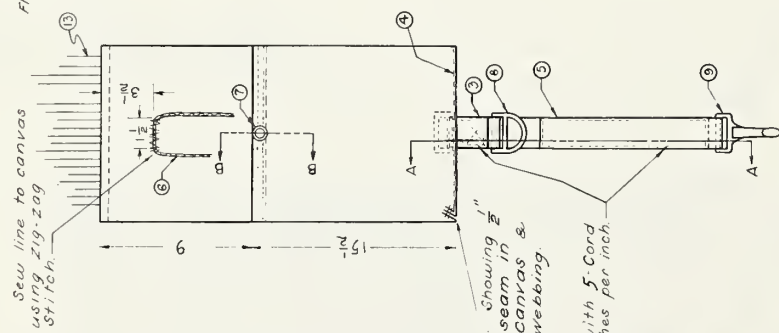
NOTE:  
FOR COMPLETE  
PACKING INSTRUCTIONS  
SEE FSH 5710



PART NO. 13 CANOPY

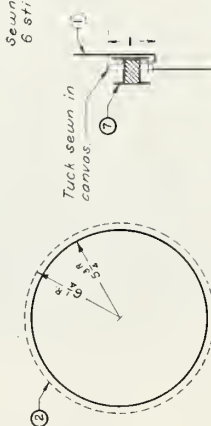
PACKED PARACHUTE

SECTION A-A

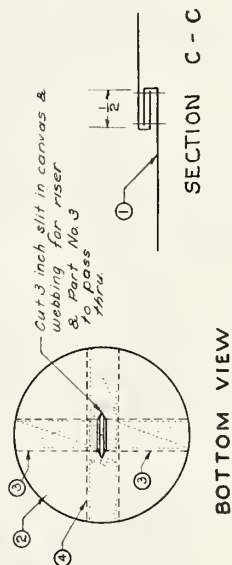


FRONT VIEW

SECTION B-B



Note:  
Dimensions given in inches.  
Ends of webbing and tie lines dipped in bees wax.  
All hems 1/2"



BOTTOM VIEW

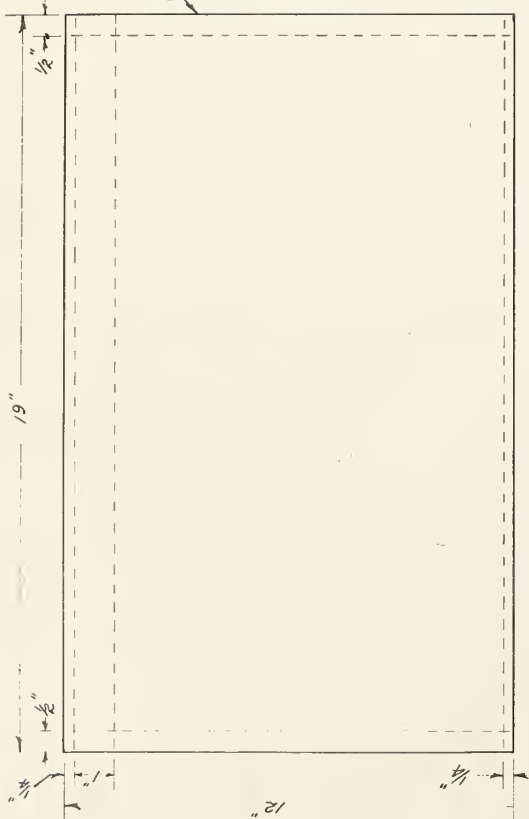
SECTION C-C

STANDARD CARGO  
PARACHUTE  
22', 24' OR 28' DIAMETER

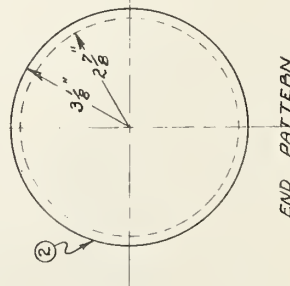


MATERIALS LIST FOR DRAWING NO. P-11A-R1

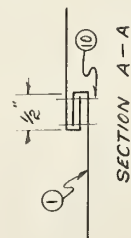
Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Specification or Number	Type
Container, main	Canvas	1	1	27" X 38"	Optional	#12	CCC-C-419, Table I	I
Container, end	Canvas	2	1	12 $\frac{1}{2}$ " X 12 $\frac{1}{2}$ "	Optional	#12	CCC-C-419, Table I	I
Reenforcing webbing	Cotton	3	2	18"	Optional	2" X 9"	MIL-W-530	III
Reenforcing webbing	Cotton	4	1	12 $\frac{1}{2}$ "	Optional	2" X 12 $\frac{1}{2}$ "	MIL-W-530	III
Riser webbing	Cotton	5	1	51"	Optional	1-3/4"	MIL-W-5665a	VIII
Tie line	Parachute cord	6	1	30"	Optional		MIL-C-5040	III, 550-lb. break strength
Lacing grommets w/washers	Brass	7	4			No. 1	MIL-G-1649 (SHIPS)	I, Plain, Symbols A&C
"V" ring	Steel	8	1		Cadmium plate	1-3/4"	AN-6563-1	Parachute
Snap	Steel	9	1		Cadmium plate	1-3/4"	43-A-21538	Parachute
Link	Steel	10	4		Cadmium plate	1-3/4"	AN-6566-1	Parachute
Break-cord ring	Iron	11	1		Black japanned	#7, 3/4"	Anchor brand or equal	Harness
Sewing thread	Cotton	12				12/4 cord	V-T-276b, ticket #12	I-A1
Canopy		13	1		Optional	22', 24' or 28'	Military personnel	Surplus military



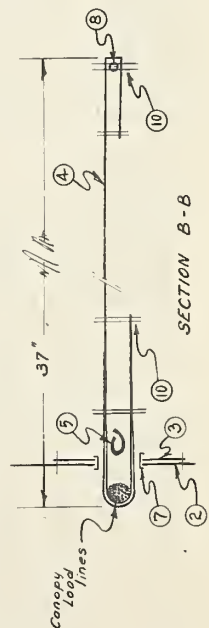
CONTAINER PATTERN



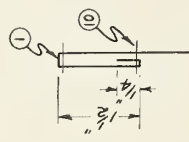
END PATTERN



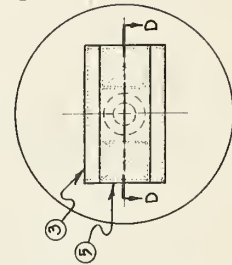
SECTION A-A



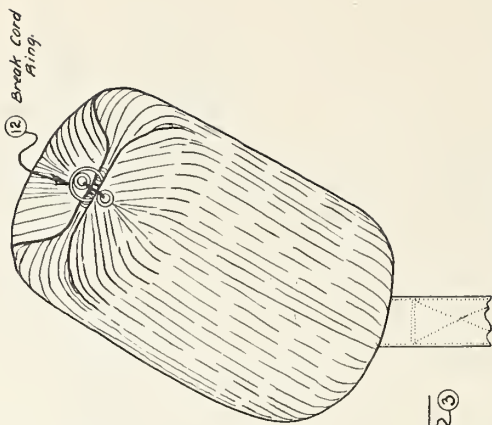
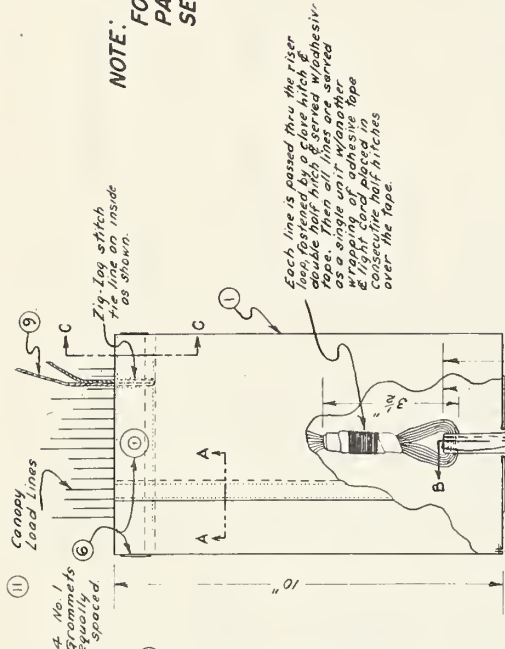
SECTION B-B



SECTION C-C



BOTTOM VIEW



STANDARD CARGO PARACHUTE  
12' OR 14' DIAMETER

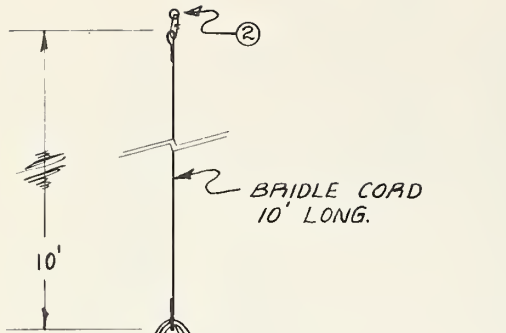
CANOPY  
PART NO. 11

NOTE:  
FOR COMPLETE  
PACKING INSTRUCTIONS  
SEE FSH 5710

Each line is passed thru the riser loop, fastened by a clove hitch & secured by a single unit of adhesive tape. Then all lines are secured as a single unit by another wrapping of adhesive tape & the lines are secured by consecutive half hitches over the tape.

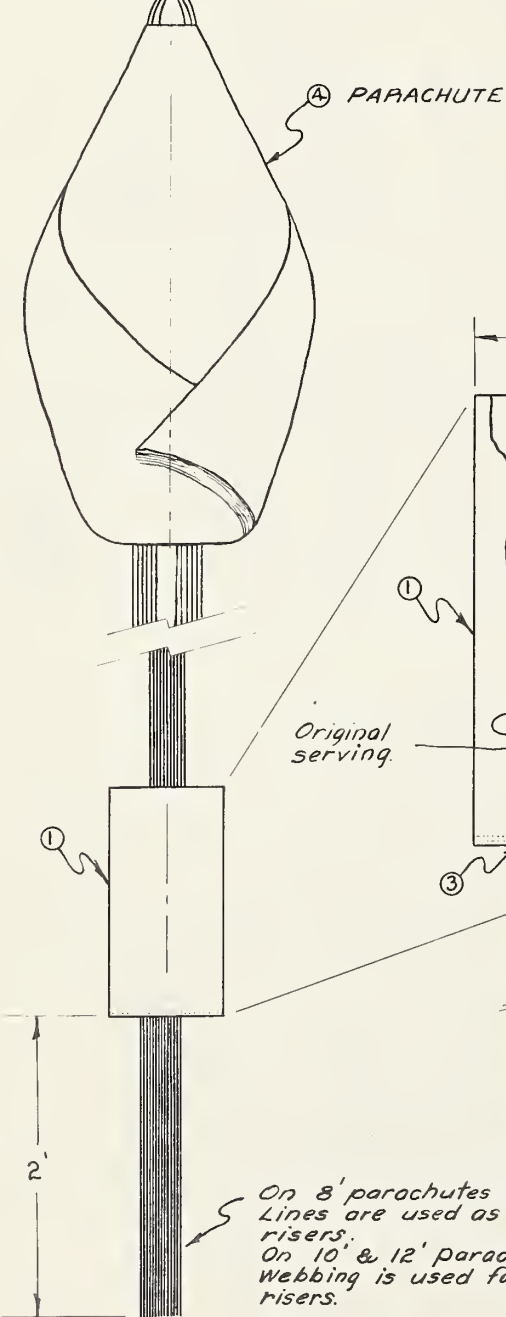
MATERIALS LIST FOR DRAWING NO. P-23A-RL

Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Specification or Number	Type
Main panel	Cotton duck	1	1	19" X 12"	Optional	#12	CCC-C-419, Table I	I
Bottom panel	Cotton duck	2	1	3-1/8" dia.	Optional	#12	CCC-C-419, Table I	I
Reenforcing webbing	Cotton webbing	3	1	4"	Optional	1-3/4"	MIL-W-5665a	VIII
Riser webbing	Cotton webbing	4	1	46"	Optional	1-3/4"	MIL-W-5665a	VIII
Retaining webbing	Cotton webbing	5	1	5"	Optional	1-1/4"	MIL-W-5665a	III
Lacing grommets w/washers	Brass	6	4ea.		Optional	#1	MIL-G-16491 (SHIPS)	I, Plain, Symbols A&C
Bottom grommets	Brass	7	1		Optional	#6	MIL-G-16491 (SHIPS)	I, Plain, Symbols A&C
Riser Tie string	Parachute cord	8	1	18"	Optional		MIL-C-5040	III, 550-lb. break strength
Container tie string	Parachute cord	9	1	18"	Optional		MIL-C-5040	III, 550-lb. break strength
Sewing thread	Cotton	10			Optional	12/4 cord	V-T-276b, ticket #12	Type I-A1
Canopy	Lightweight rayon or nylon	11	1		Yellow	12' dia.	Signal Corps film delivery parachute, Model M-390-A	Surplus military
Break-cord ring	Iron	12	1		Black japanned	#7, 3/4"	Anchor brand or equal	Harness



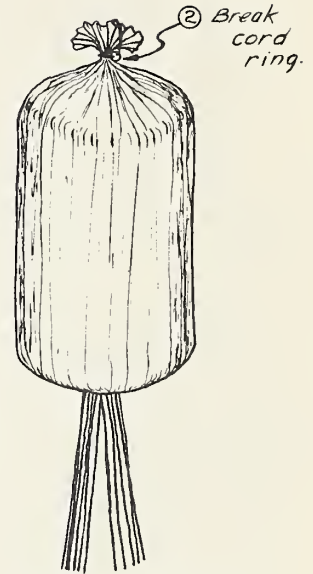
NOTE:  
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SEE FSH 5710.

PART NO. 1 MUSLIN  
BAG 10 TO 25 LBS.  
CAPACITY.



On 8' parachutes the  
Lines are used as  
risers.  
On 10' & 12' parachutes  
Webbing is used for  
risers.

CARGO PARACHUTE  
LAYOUT



PACKED PARACHUTE

Extend lines  
thru bottom  
of bag and  
sew thru bag  
and lines.

CARGO PARACHUTE  
WITH MUSLIN CONTAINER  
8', 10', OR 12' CANOPY

MATERIALS LIST FOR DRAWING NO. ED-153-R1

Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Specification or Number	Type
Container	Muslin	1	1	19" X 19"	Natural		Common muslin, bleached or unbleached	
Break-cord ring	Iron	2	1		Black japanned	#7, 3/4"	Anchor brand or equal	Harness
Sewing thread	Cotton	3			Optional	12/4 cord	V-T-276b, ticket #12	Type I-A1
Canopy		4	1		Optional	8', 10' or	Fragmentation-bomb, glider-deceleration or film-delivery.	Surplus military

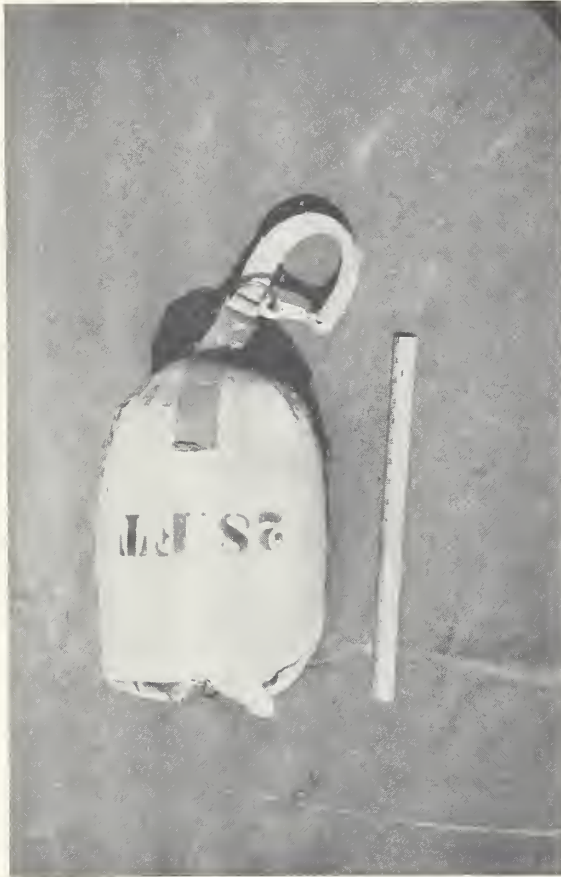




U.S.D.A.

FOREST SERVICE

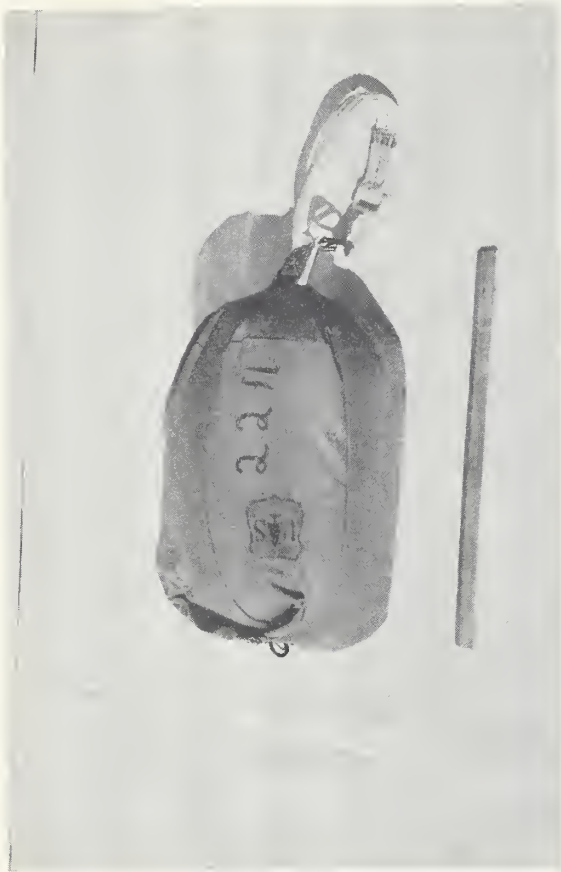
CARGO PARACHUTES CATALOG



Name	Description	Load (pounds)	Rate of Descent (f.p.s.)		
			Sea level	3200 feet	5000 feet
Standard cargo parachute 28' diameter	Circular-flat, nylon or silk, white, converted military-personnel canopy. Container is cylindrical, canvas, and is used as retrieving bag. Deploys canopy first by static line attached to aircraft. Static line snap is hooked into black iron ring which is tied to a 10-foot bridle cord with a single loop of 80-pound cloth tape (MIL-T-5661, Type I, $\frac{1}{4}$ -inch wide). Container mouth is laced shut with a single strand of 40-pound thread which is passed through iron ring once only. Weight 15 lbs.  See Drawing No. P-11A-R1	75	11.96	13.02	13.1
		175	18.2	19.3	20.7
		275	22	23.3	24.1

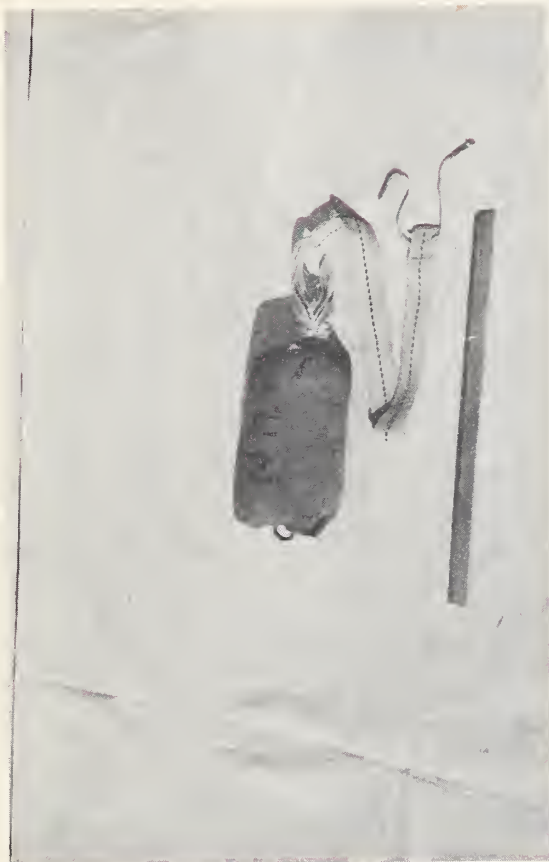


Name	Description	Load (pounds)	Rate of Descent (f.p.s.)		
			Sea level	3200 feet	5000 feet
Standard cargo parachute 24' diameter	Circular-flat, nylon or silk, white, converted military-personnel canopy. Container is cylindrical, canvas, and is used as a retrieving bag. Deploys canopy first and except for size is identical to the 28-foot standard cargo para- chute. Canopy may be equipped with pocket bands. Weight 12 lbs.  See Drawing No. P-11A-R1	50	12.7	13.5	13.9
		150	17.8	18.9	19.5
		200	21.4	22.7	23.5



Name	Description	Load (pounds)	Rate of Descent (f.p.s.)		
			Sea level	3200 feet	5000 feet
Standard cargo parachute 22' diameter	Circular-flat, nylon or silk, white, converted military-personnel canopy (may or may not be rip-stop weave cloth). Container is cylindrical, canvas, and is used as retrieving bag. Deploys canopy first and except for size is identical to 28' standard cargo parachute. Weight 10 lbs.  See Drawing No. P-11A-RL.	50	14.0	14.9	15.4
		125	18.7	19.8	20.5
		200	23.4	25	25.7

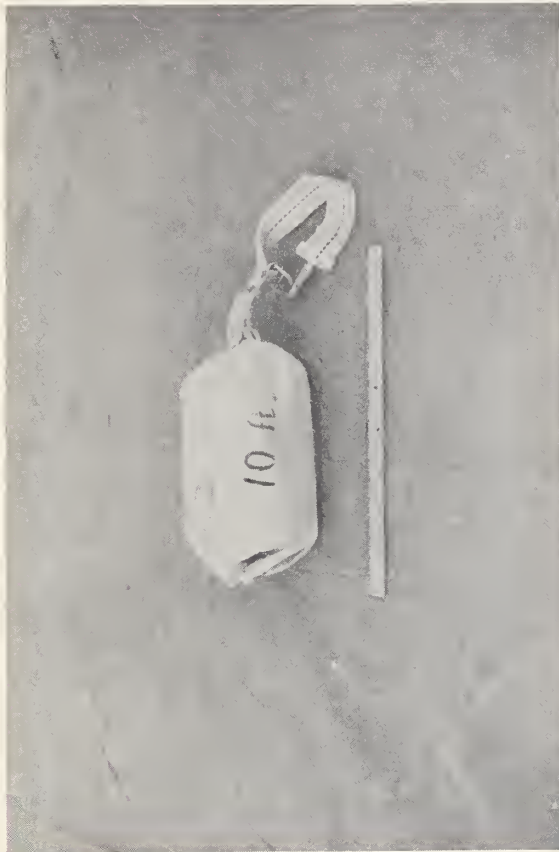




Name	Description	Load (pounds)	Rate of Descent (f.p.s.)		
			Sea level	3200 feet	5000 feet
Standard cargo parachute 14' diameter	Circular-flat, lightweight silk, converted military-flare parachute. Container is cylindrical, canvas, and is used as retrieving bag. Deploys canopy first by static line attached to aircraft. Static line snap is hooked into black iron ring which is tied to apex bridle cord with a single loop of 25-pound break-cord. Container is laced shut with single loop of 25-pound break-cord. Lacing cord is passed through iron ring once only. Weight 1 lb.  See Drawing No. P-23A-R1.	10	10.2	10.9	11.1
		50	19.3	20.6	21.3
		80	24.5	25	26.9



Name	Description	Load (pounds)	Rate of Descent (f.p.s.)		
			Sea level	3200 feet	5000 feet
Standard cargo parachute 12' diameter	Circular-flat, rayon, lightweight, yellow, converted from military Signal Corps film-delivery parachute. Container is cylindrical, canvas, and is used as retrieving bag. Deploys canopy first. Except for canopy size and color, it is identical to 14-foot standard cargo parachute. Weight 1 lb.  See Drawing No. P-23A-R1.  Military version of this canopy is M-390-A.	10	12.1	12.9	13.3
		35	19.3	20.4	21.2
		65	24.8	26.4	27.4



Name	Description	Load (pounds)	Rate of Descent (f.p.s.)		
			Sea level	3200 feet	5000 feet
Standard cargo parachute 10' diameter	Circular-flat, nylon, white, heavyweight cloth, converted military, glider-deceleration parachute. Container is used as retrieving bag. Deploys canopy first. Container may be either muslin similar to 8-foot cargo chute or cotton duck similar to standard 28-foot cargo chute (scaled down to size). Weight 3-3/4 lbs.  Military designation of this parachute is Model 44-G-5495.	10	12.8	13.7	14.0
		30	17.1	18.2	18.9
		50	23.6	25	25.9



Name	Description	Load (pounds)	Rate of Descent (f.p.s.)		
			Sea level	3200 feet	5000 feet
Standard cargo parachute 8' diameter	Circular-flat, rayon-heavyweight, white, converted military fragmentation-bomb parachute. Container is simple muslin sack, 25-pound capacity, and is used as retrieving bag. Deploys canopy first by static line attached to aircraft. Static line snap is hooked into black iron ring which is tied to apex bridle cord with a single loop of 25-pound break-cord. Container mouth is tied off with a single 25-pound cord which passes through black iron ring once only. Weight $3\frac{1}{2}$ lbs.  See Drawing No. ED-153-R-1.  Military version of this parachute is Model G-8.	5	15.4	16.4	16.9
		10	19.1	20.2	21.0
		25	30.2	32.0	33.1





